# ASSESSMENT OF OPPORTUNITIES FOR COMPUTER HARDWARE AND SERVICES IN THE FAA/ATC MARKETPLACE

Prepared for

Digital Equipment Corporation
Government Systems Group
Continental Boulevard
Merrimack, New Hampshire 03054

From

INPUT
Parsippany Place Corporate Center
959 Route 46 East, Suite 201
Parsippany, New Jersey 07054

January, 1988

CONTENTS

List of Exhibits



Attachments

# I. INTRODUCTION

o This section contains a statement of the objectives of the study that was performed by INPUT for Digital Equipment Corporation, together with a statement of the scope of the project. In addition, this section describes, in detail, the methodology that was employed throughout the project as the means of reaching the stated objectives.

## A. Objectives

1. To define the FAA and ATC organizations in the context of their mission responsibilities and their utilization of various types of information systems in support of their missions.
2. To determine, wherever possible, the current computer hardware that is being utilized in the various applicable information systems.
3. To determine, and describe, the information systems programs that are either under development or are planned for future development.
4. To summarize the planned expenditures related to the various information systems projects within the FAA/ATC marketplace.
5. To determine, wherever possible, the leading vendors in the FAA/ATC systems marketplace.
6. To determine what share of the FAA/ATC systems marketplace might be available to DEC in the timeframe beginning with fiscal year 1987 and extending through fiscal year 1991.

7. To provide DEC with INPUT's conclusions and recommendations relative to the potential market for DEC within the FAA/DEC.

B. Scope

o The scope of the project is defined as follows:

1. The project focuses solely on the Air Traffic Control (ATC) portion of the Federal Aviation Administration (FAA). Further, within the context of the ATC, the project focuses solely on those information systems which have to do with air traffic operations. That is, administrative and management oriented systems are not included in the scope of the project (e.g., human resource systems, payroll systems, management information systems, etc.).

2. The only projects that are included in the scope of this report are those that have already been described within documentation published by the U.S. Department of Transportation. In effect, this limits the scope of the project to ATC expenditures through the U.S. Government's fiscal year 1991. Any expenditures beyond fiscal year 1991 are not described in existing government documentation and are considered too nebulous to focus on, within the scope of this project. (See 4, below.)

3. The project includes systems expenditures only for hardware and professional services. That is, ATC expenditures for batch computer services, remote computer services, facilities management services, packaged software, etc., are excluded.

4. During the course of the study, it became apparent that the majority of the funds that will become available for FAA/ATC purposes during the time period extending through 1991 are not included in the various systems planning documents published by the various Federal DOT/FAA/ATC agencies. Therefore, the scope of this study has been expanded beyond the original concept in order to provide DEC with information that is more meaningful in the context of their planning process.

C. Methodology

1. The documentation pertaining to the Federal Aviation Administration's National Airspace Systems Plan, together with all known related documentation, was reviewed in detail. This review was performed as the first step in identifying those systems projects which are planned by the FAA/ATC during the applicable timeframe.

2. In the context of step 1, above, the FAA/ATC's Information Resources Management Plan was also reviewed in detail. This review enabled INPUT to begin to define some of the specifics of those projects which were considered to be applicable to DEC's interest in the ATC systems marketplace.

3. Ancillary data from both primary and secondary sources was obtained in order to supplement the information obtained in steps 1 and 2, above.

4. Each applicable ATC operational system project was described in summary form.

5. Once the various applicable projects were identified, INPUT developed a microscopic forecast of applicable ATC system expenditures through fiscal year 1991.

6. A questionnaire was developed and utilized in a series of telephone interviews with applicable FAA and ATC personnel. The purpose of these interviews was to determine the accuracy and validity of the data that had been collected during the course of the project and to complete any missing informational elements.

7. Additional information was obtained from a variety of sources concerning the funding potential for FAA programs that will probably be made available by Congress from a trust fund established by the Airport and Airways Development Act, as amended, and other provisions of law. This information was reviewed with FAA personnel, and others, and was factored into the report, but kept separate from the more detailed, empirical data.

8. A series of conclusions and recommendations were developed, based on the empirical data gathered and described in the course of the project.

9. The final report was prepared and submitted to DEC.

## II. OVERVIEW OF THE FAA/ATC SYSTEMS MARKET

This chapter contains an overview of both the FAA organization and the ATC organizations, with emphasis on the systems function in each. It is considered important for the reader to understand the overall organizational structure of these agencies so that there can be a more meaningful understanding of the various systems projects described in the latter portion of this report.

### A. FAA Organization

- The Federal Aviation Administration (formerly the Federal Aviation Agency) was established by the Federal Aviation Act of 1958. It became a component of the Department of Transportation (DOT) in accordance with the Department of Transportation Act.
- The FAA consists of two basic administrative levels of organization, in four special complexes, as follows (see Attachment 1 for an FAA organization chart):
  1. The FAA headquarters in Washington, DC, responsible for agency wide program planning, direction, control, and evaluation. FAA headquarters is also responsible for conducting certain operational activities.
  2. FAA regions, each under a director who is responsible for directing the field operations within assigned geographic boundaries.

3. An aeronautical center in Oklahoma City and an FAA technical center near Atlantic City, NJ, where a variety of centralized activities are conducted.
4. A variety of other minor FAA facilities which are not pertinent to this study.

B. FAA Functional Responsibilities

o The FAA's functional responsibilities can be summarized through five mission statements:

1. The promotion of aviation safety.
2. The efficient utilization of airspace.
3. The promotion of air commerce and aviation at home and abroad.
4. The fulfillment of national defense requirements.
5. Efficient and economical program administration.

o More specifically, the FAA has recently decided to embark on a major program to update the National Airspace System (NAS). This is a very broad system program because, in addition to managing air traffic, the FAA is also the primary source of many kinds of information and services which are essential to the industry; but not directly related to air traffic control. These services include such things as:

- Aircraft and airport standards
- Aircraft certifications

- Aviation regulations
- Pilot examinations and certifications
- Aviation statistics

o The information resources management program of the FAA has been initiated to upgrade, coordinate, and integrate all the major information systems which are not included in the real time systems used for the management of national airspace.

o The Information Resources Management (IRM) planning process was first undertaken in 1983 so that the FAA, and its management, would have the opportunity to develop a comprehensive set of information systems which would encompass all the various activities of the FAA.

o The FAA's approach to information resouces management is a comprehensive one. It is well documented and includes the following:

1. The IRM program and activities are guided by the FAA's long term strategic plans and shorter term technical plans. These plans are reviewed each year and updated as needed.
2. The FAA has established a series of centralized automatic data processing (ADP) facilities which provide the general purpose hardware and software needed to support the essential information activities of the FAA. The centralized ADP organizations also

provide the standards, procedures, and technical expertise that are applicable to the FAA's systems environment.

3. The FAA has established an information resources planning branch within the Office of Management Systems. The purpose of this branch is to coordinate and integrate the systems efforts within the various individual organizations comprising the FAA.
4. The FAA has established an Information Resources Management Executive Committee (IRMEX) to insure top management attention and involvement in major decisions concerning the IRM.
5. Each region and center within the FAA has an information resource manager who acts as the focal point for the agency's IRM programs and activities.
6. In addition, the FAA has an information resources management committee (IRMC) which provides a vehicle for coordinating, consulting, and advising IRMEX and the information resources planning branch on proposed IRM plans, programs, policies, procedures, and standards.

o As a means of illustrating the above, Attachment 2 shows the information flow, and reporting responsibilities, for various IRM activities within the FAA. As the ATC is a component of the FAA, the flow shown in Attachment 2 is, of course, pertinent to the ATC, as well as other FAA organizational elements.

C. ATC Organization

o The Air Traffic Control (ATC) portion of the FAA is one of two operational units within the FAA. The other operational unit is the Airports area. Airports is responsible for the planning, development, and standardization of airport facilities throughout the United States.

o The ATC is, as its name implies, responsible for all aircraft activities within the United States, and several geographic areas outside the United States. In the context of this report, we have defined the operational areas that are of interest to DEC as:

1. Air Traffic Control (ATC) area, and,
2. Air Space Information area.

Within these two areas there are five overall systems which support all of the operational functions within the ATC and the Air Space Information area. They are:

1. The Aeronautical Information System (AIS)
2. The Obstruction Evaluation in Airport and Airspace Analysis area (OEAAA).
3. The Instrument Approach Procedures Automation area (IAPA).
4. The Air Traffic Control Procedures and Separation Standards (ATCPSS).
5. The Air Traffic Operation and Management area (ATOM).

o Within the context of the above, the ATC has developed certain key issues which are to be addressed as the primary

goals and objectives of the various information systems and which are pertinent to the ATC and Air Space Information areas. The basic concepts that are addressed by these various systems are as follows:

1. All aeronautical information systems in the National Flight Data Center will be integrated.
2. There will be a centralized data base for ATC procedures and separations standards.
3. The planned systems will be developed with the uniform application of ATC operational and management data.
4. The majority of the existing manual tasks involved with obstruction evaluations of proposed construction, with airport space analysis of landing area proposals, and with non-Federal navigational aid proposals, will be automated. The planned information systems will automate the process of producing instrument flight procedures and enlarge the flight inspection database. These systems will also incorporate a scheduling record for instrument approach procedure reviews and provide a better summary of aircraft program costs.

o As can be seen from Attachment 1, the ATC is sub-divided into three functional areas:

1. Air traffic operation services
2. Air traffic plans and requirements services
3. Office of air traffic evaluations and analysis.

The various ATC systems outlined in subsequent portions of this report are primarily oriented to the ATC's air traffic operations service. While this is but one of many blocks on the organization chart, it is this function which is responsible for virtually all of the information systems which pertain to the operational aspects of the ATC.

- As a means of emphasizing the level of aviation activity for which the ATC is responsible, the following information is presented:

  1. The U.S. National Airspace System accommodates over 235,000 active civil and military aircraft. While the performance characteristics of these aircraft vary widely, the overall trend is toward the production of more sophisticated aircraft which make greater use of controlled airspace and the various services which the ATC provides.
  2. The continuing growth in the number of aircraft operations, the diversity of operations, the number and sophistication of aircraft, will place unprecedented demands on the National Airspace System from now through the turn of the century.
  3. Based on the above, the safe and efficient operation of the National Airspace System will require improved services, new facilities for system expansion, and the orderly replacement of aging facilities and systems to provide for adequate aircraft and airport control and capacity.

4. Attachment 3 contains statistics indicating the growth in aviation activities for selected years through the period 1982-2000.

5. Utilizing the data contained in Attachment 3, the following statistics can be derived:

   - aircraft operations (take offs and landings) are estimated to grow by 42%, between 1982 and 2000.
   - IFR (Instrument Flight Rule) operations will increase by 76% between 1982 and 2000.
   - Commercial air carrier departures are expected to increase by 159% between 1982 and 2000.
   - Commuter aircraft departures are expected to increase by 255% between 1982 and 2000.

D. FAA/ATC Systems Programs - Policies and Strategies

o The FAA/ATC has developed, and set forth, a set of policies and strategies pertaining to all systems development activities. It is considered important for DEC personnel to understand these strategies so that they may be better informed as they consider ATC as a potential market area for their company's products and services. These policies and strategies have been selected from among the total set forth by the FAA/ATC. Other statements, not considered pertinent to this project, have been omitted.

1. Policies

- To automate any function when such automation is expected to result in the improved performance or management of the FAA/ATC or to result in specific cost saving or cost avoidance.
- To utilize advanced ADP techniques, but only where they have already been proved to be efficient or effective. (That is, the FAA/ATC indicates it will not become involved in experimental hardware or software.)
- To provide a centralized management overview of all FAA/ATC ADP activities.
- To provide for the rejustification of ADP systems every three years; on a recurring basis.
- Each national program organization within the FAA/ATC will budget and fund efforts for all end user ADP projects.

2. Strategies

- The FAA/ATC will focus on a systems integrator concept for ADP projects. That is, the intent is to have a single vendor provide equipment and support to meet all of the FAA/ATC system requirements.
- It is the FAA/ATC's intent to continue to contract with the same vendor for upgrades and enhancements to support future systems growth.
- The FAA will divest itself of all technical and operational functions for supporting systems and hardware that are currently in place.

- The FAA/ATC's strategy is to minimize future software and development costs by supporting data systems with FIPS-compatible general purpose standardized software.

E. Highlights of the FAA/ATC Systems Plan

1. Enroute and Terminal ATC

- With regard to the ATC enroute and terminal systems, the plan has three principal thrusts:
  a. Major facilities will be consolidated; from more than 200 today to less than 30 by the year 2000.
  b. Common modular computers, software, and controller work stations (i.e., sector suites) will increase the ATC's capacity and availability.
  c. Higher levels of ATC automation will improve safety, fuel efficiency, and productivity.
- Enroute and terminal facilities will be consolidated into area control facilities (ACF), with most hardware and software elements identical among the ACF's. The central computers and sector suite's used within ATC will be identical at all ACF's.
- Within each ACF, the advanced automation system (AAS) will have computer processing divided between common processing equipment and the individual sector suite. Sector suites will provide a new environment in which air traffic controllers can function more effectively. In a typical sector suite, multiple displays will provide a plan view of

the air traffic and weather situation, alpha-numeric flight and weather data, and other aeronautical information. Sector suite processing capability will insure that required surveillance, flight data, and weather information is available at the particular controller position.

- Distributed processing will provide high system availability and protection from total system failure. Increased operational flexibility can also be achieved since the number of controller operating positions can be reconfigured to meet changing demand, based on day-to-day or hour-to-hour workload requirements.
- By the year 2000, enroute and terminal functions will be consolidated into area control facilities. This consolidation will transform all enroute centers in 188 terminal facilities to less than 30 major air traffic control facilities. Existing airport traffic control towers will remain in place and will be supported by advanced processing and display capabilities.

2. Flight Services and Weather

- As stated previously, flight service systems include both flight service stations and aviation related weather systems. In summary, the information resource management plan allows the ATC to reach the following three goals, regarding flight services and aviation weather:
  a. Automation and consolidation will allow better, more complete flight services, while constraining costs.

b. Direct automated pilot access will provide "one stop" service for weather, flight plan filing, and information about air traffic system status.

c. Greatly improved aviation weather services will increase pilot and passenger safety and will be tailored to meet individual requirements.

- By the year 2000, the system will have the capability to provide the majority of flight services directly to pilots, without specialist intervention. The system will also provide weather database access to specialists, on an interactive basis.
- An enhanced weather function, operated by a meteorologist, will be located in each area control facility. Aviation weather collection, processing and dissemination will be greatly enhanced. The intent of this system is to provide current aviation weather information throughout the national airspace system for pilots, center and tower controllers, flight service specialists, and traffic management personnel.

F. Summary of the FAA/ATC Systems Plan (the Information Resource Management Plan: IRMP)

- The initial IRMP was published by the FAA in August, 1983. This plan was a result of the FAA administrator's concept of launching a high priority planning process for all areas

within the FAA. The IRMP was undertaken so the FAA, and its managers, would have the opportunity:

1. To review needs and opportunities to improve agency operations through the application of information and systems technology.
2. To deliberately choose directions and strategies in achieving FAA/ATC goals and objectives.
3. To review information systems priorities, and to coordinate them with the FAA/ATC mission priorities and activities.
4. To obtain the active participation at all FAA levels in the identification of systems needs and improvements.
5. To evaluate the long and short term costs and benefits related to systems activities.

- Also, in 1983, the IRMP team developed a new and simplified planning process which was aimed at incorporating the broad and constructive participation of various management levels throughout the FAA organization.
- The original IRMP issued in August, 1983, has been replaced by two subsequent documents, Vols. 1 and 2 of the Systems Plan for FY 1987 through FY 1991. It is these documents which were heavily used by INPUT in preparing the more detailed information contained in Chapter III. The FAA has set forth certain key planning assumptions pertaining to the existing IRMP. These assumptions are:

1. FAA operating resources will stay constant, or decline, in current dollars.

2. FAA personnel levels will drop steadily throughout the planning period.

3. There will be a steadily decreasing number of staffed facilities and field offices conducting FAA business.

4. Unit personnel costs will tend to increase while unit ADP hardware costs will tend to decrease.

5. Professional, in-house ADP personnel resources will continue to decline. Thus, users will have to assume greater responsibility for software development and modification with their own, or contracted, personnel.

6. ADP technology will cause a steadily increasing dispersion of ADP expertise and capability, throughout the FAA.

7. Increasingly large amounts of central processing resources will need to be devoted to the growing sophistication of the software required by both users and information managers.

8. The general public will continue to demand continuing reductions in the cost of all elements of government, whether they are administrative, legislative or judicial.

G. IRMP - Functional Systems Activities

o The functional information systems activities that will result from the implementation of the IRMP are as follows:

1. Airports information requirements.
   - A set of integrated data systems providing current information on all U.S. airports.
2. Air traffic control and airspace information requirements. This involves:
   - The integration of all aeronautical information systems.
   - A centralized database for all ATC-related data.
   - The automation of certain tasks which are now performed manually.
   - The automation of the process of producing instrument flight procedures.
3. Aviation activity information requirements.
   - These systems will provide a single focus for managing all information pertaining to aviation activity in the U.S.
4. Aviation safety analysis system.
   - This planned system requires the development and implementation of an automated certification and safety information system.
5. Financial resources information system.
   - This system will incorporate budgeting, allocation, accounts receivable, accounts payable, and payroll systems.

6. Human resources information requirements.
   - This system will encompass all personnel activities within the FAA.
7. Material resources information system.
   - This will be a centralized inventory management system enabling the FAA to report, track, control, and account for all hard assets within the FAA.
8. National Airspace System facilities information requirements.
   - This system will involve the implementation of a single NAS facilities information system. This will involve a:
     . maintenance management system
     . program management system
     . executive or summary database system.
9. Office automation and management support.
10. Information processing and support.
    - A centralized storage and retrieval system.
11. Human interface and training.
    - This will be an automated training and computer assisted instruction system.
12. Record management system.

H. The ATC and the Airspace System Information Requirements

1. There are three major components comprising the air traffic control system. They are:

   a. Enroute air traffic control.

   b. Terminal air traffic control.

   c. Flight service stations.

2. Air route traffic control centers (ARTCC). The ARTCC controls all enroute aircraft in the United States which are operating under instrument flight rules (IFR) and are not under the control of military, or other, facilities. The centers provide separation service, traffic advisories, and weather information to pilots while they are enroute between airports.

3. Terminal air traffic control facilities include the following:

   a. Airport traffic control towers (ATCT)

   b. Terminal radar approach control (TRACON)

   c. Terminal radar approach control in the tower cab (TRACAB)

   Airport traffic control towers separate and sequence aircraft in the airspace immediately surrounding airports and on the airport surface. Approach control facilities provide separation services to aircraft during the arrival and departure phases of flights in a larger amount of airspace surrounding airports.

4. Flight service stations offer a wide range of services to the large general aviation public which would not otherwise

be available. Services include flight plan filing and closing, preflight and inflight weather briefings, enroute communications for pilots flying under visual flight rules, and assistance to pilots in distress.

5. ATC information resource management plan. Within the ATC portion of the plan, the following improvements will be implemented:

   a. Enroute system computers will be replaced. More functions will be automated, communications will be modernized, traffic management will be improved and all ATC functions will become more highly integrated.

   b. Terminal systems will be upgraded and expanded. Software will be enhanced, communications will be improved and integrated, and some terminal system functions will be consolidated.

   c. Flight service systems will be consolidated and automated. Weather information will be more current and widely disseminated, and communications will be integrated with other elements of the system.

I. Description of the ATC System Environment

This subsection will provide a description of the operational environment into which the various ATC operational systems will be embedded.

1. Enroute System

   a. Commercial airlines, and other aircraft flying under instrument flight rules and not under the control of military or terminal facilities, are monitored by air route traffic control centers. These centers control an aircraft's flight route between airports. They provide separation services, traffic advisories, and weather advisories. Aircraft flying under visual flight rules (VFR) are also monitored by these centers; if they are in an area that has radar coverage. In addition, the air route traffic control centers assist aircraft in distress. The ATC enroute system is an intrinsic part of this country's national defense system.

   b. Another intrinsic part of the enroute system is the Central Flow Control Facility. This is the ATC command center in Washington, DC. This facility serves as a focal point for evaluating and improving traffic flow redistribution and the nationwide management of air traffic flow. It also provides authority for initiating system wide flow control. Central Flow Control, as associated with the airport reservation function (ARF), relieves congestion at the country's busiest airports.

c. A typical center is responsible for more than 100,000 square miles of air space and hundreds of miles of airways. A current center's geographic area is usually divided into 30 or more sectors, with a team of controllers responsible for each sector.

d. There are currently 20 Air Route Traffic Control Centers in the continental United States. There are also four off-shore centers, located in Anchorage, Alaska; Honolulu, Hawaii; San Juan, Puerto Rico; and Guam.

e. The Air Traffic Control System determines correct aircraft separation based on radar data input. Flight data is displayed on paper strips torn from flight strip printers. VHF and UHF radios are used to provide pilots with traffic advisories and route clearances.

f. The 20 enroute centers presently use 9020 computers, developed in the 1960's, to process radar and flight data. Despite their capabilities, the current 9020 computer systems are not expected to be adequate for handling the projected growth in aviation traffic beyond the late 1980's.

g. The present enroute center system is labor intensive. A great deal of manual effort is required of air traffic controllers. There is also a high level of hardware and software maintenance costs associated with

its operation. Computer equipment manufacturers can not provide parts indefinitely for these systems, regardless of cost.

h. In August, 1984, competitive contracts were awarded to two hardware vendors for the design of new, advanced automation systems. These systems included sector suites with distributed processing computers. Further, these contracts provide for the design of replacement software partitioned to run in both centralized computers and sector suites. Operations requiring centralized processing will be performed in the centralized computers, with all remaining functions performed in the individual sector suites.

i. A typical sector suite will contain displays which present a plan view of the current air traffic situation, such as:

   1. Position of aircraft in real time weather.
   2. Electronic display of flight data.
   3. The display of planning information and advanced air traffic control functions.

j. The capability of the system to support both enroute and terminal functions allows for the consolidation of these two functions into area control facilities. The ATC will enhance the display of Central Flow Computer conflicts at the FAA technical center in the late 1980's, to provide more coverage in prediction features

for the NAS. The long range goal is to couple this traffic management capability with area control facilities for total national flow management.

2. Terminal Systems

   a. The three major types of physical facilities used in the terminal air traffic control complexes are:

      - Airport traffic control tower (ATCT)
      - The terminal radar approach control (TRACON)
      - The terminal radar approach control in the tower cab (TRACAB).

   b. Located at airports, the ATCT's are the most common terminal facilities, as well as the most visible. Their purpose is to separate aircraft, sequence aircraft in the traffic pattern, expedite arrivals and departures, separate aircraft on the landing areas, and provide clearance and weather information to pilots.

   c. The second most common are the TRACON's that control air space around those airports with moderate to high density air traffic. TRACON controllers separate and sequence both arriving and departing flights. Normally, each TRACON is associated with one ATCT and located within the same building. However, a TRACON may be remotely located and may serve more than one ATCT.

d. The third type of facility, the TRACAB, serves a function similar to that of the TRACON. TRACABS are located within tower cabs at airports with lower density traffic.

e. All terminal air traffic control facilities are equipped with radio communications to aircraft. There are also telephone communications to air route traffic control centers and flight service stations. Each ATC control facility has a variety of equipment for observing, detecting, receiving, and displaying weather information.

f. Terminal ground-to-ground communications use a variety of older switching systems. These systems vary in range and complexity from simple systems used in many small ATCT's to Western Electric 301 and 301A systems used at TRACON's.

g. At qualifying terminal ATC facilities, computers are used to relieve the controller of routine tasks and give the controller information that assists him in maintaining aircraft identification. In addition, information such as altitude and aircraft speed is displayed on the controller's screen by means of alpha-numeric symbology.

h. The system's TPX 42 equipment is the least sophisticated of the terminal automation systems. It is a non-programmable, numeric beacon decoder system.

That is, information from an aircraft's transponder is decoded and displayed for the controller in numeric form along with normal radar data. It provides aircraft transponder code and altitude information for suitably equipped aircraft. TPX 42 systems are used at lower activity terminal radar facilities.

i. The automated radar terminal system (ARTSII) is a programmable, non-tracking data processing system. Although it does not provide aircraft tracking, the ARTSII system does provide meaningful information such as aircraft identification, and altitude. Like TPX 42, ARTSII derives its information only from the aircraft's transponder. ARTSII can be interfaced with the ARTCC computer for the automatic exchange of information. ARTSII is used for facilities having low to medium activity. At present, ARTSII has no unique software other than minor adaptations to the basic operational software programs.

j. The third terminal system, ARTSIII, is a programmable beacon tracking system. The transponder in the ARTSIII system detects, tracks, and predicts the position of aircraft in the terminal area. The information is displayed on the controller's radar scope by means of computer generated symbols and alpha-numeric characters, along with normal radar data. The computer displays aircraft identification, altitude, ground

speed, and flight plan data. In addition, ARTSIII is interfaced with the ARTCC computer allowing these different computers to exchange information.

k. At present, ARTSIII is installed at medium-to-high activity terminal facilities. Currently, there are two unique features provided by ARTSIII through software. The first is a minimum safe altitude warning (MSAW) capability. MSAW is a function of the ARTSIII system that will alert the controller when a tracked aircraft, with altitude reporting capability, is below, or is predicted by the computer to go below, a predetermined minimum safe altitude. The second system capability is conflict alert. Terminal conflict alert (CA) is a system function that alerts the controller to a situation in which aircraft are in close proximity and possibly require attention or action.

l. In addition, there is a further enhancement, the ARTSIIIA system which is designed to perform all of the ARTSIII functions but enables a controller to handle the increasing traffic demands in high volume terminal air space. The ARTSIIIA system is capable of tracking search radar targets as well as transponder-equipped aircraft. Like ARTSIII, ARTSIIIA interfaces with the ARTCC system and contains the unique software features of MSAW and conflict alert.

m. The current terminal ATC system consists of over 400 ATCT's and nearly 200 TRACON/TRACAB's.

3. Flight Service and Weather Systems

a. In 1981, there were more than 300 ATC flight service stations (FSS) offering a broad range of pre-flight and in-flight services, especially aimed at general aviation. These services included:

1. Accepting and closing flight plans
2. Conducting pre-flight weather briefings
3. Enroute communications with pilots flying under visual flight rules
4. Assisting pilots in distress
5. Disseminating aviation weather information
6. Monitoring air navigation radio aids
7. Originating notices to airmen
8. Working with search and rescue units in locating missing aircraft

b. In the interval between 1981 and 1985, the process of consolidating existing flight service stations began.

c. At certain locations, flight service stations take weather observations, issue airport advisories, provide enroute flight advisory services, and advise custom and immigration officials of transborder flights. These stations also have communications equipment for relaying information to towers and air route traffic control centers and for various emergency services.

d. Flight service stations range in size from very small facilities to large ones, employing approximately 100 people. Some of the key FSS services are those related to weather. The ATC aviation weather system collects weather information and distributes it to both pilots and agency operations personnel. Weather information is collected largely with electro-mechanical devices that give wind velocity, temperature, dew point, and other related weather oriented information. Facsimile weather maps and medium speed collection/display equipment is used.

e. The existing national network of ATC and national weather service radars has been retrofitted so that six levels of weather contouring (outlining storms) are now displayed to enroute meteorologist's at air route traffic control centers and flight service specialists at flight service stations. Satellite originated weather images, providing additional information on cloud cover and weather systems, have also been provided to some of these locations through the implementation of facsimile recorders.

## III. DESCRIPTION OF SPECIFIC SYSTEM PROJECTS

- This chapter contains a brief outline of those ATC flight operational support system projects which INPUT believes would be of specific interest to Digital Equipment Corporation. In each case, the project is identified by title and FAA project number, and briefly described.

- Subsection A contains a description of those ATC projects which are currently categorized as planned development projects. In these cases, and where available, the following information is presented:
  - Major milestones
  - Total development costs
  - Related information system projects

- Subsection B of this chapter describes those ATC information systems projects which are already in place and are budgeted for modifications or for enhancements. In these cases the following additional information is presented:
  - System hardware
  - Annual system operating costs

A. Planned Development Projects

1. National Flight Data Center (NFDC) Aeronautical Information Management Program

a. Project designation: 020406

b. Description

- This project focuses on the development of a comprehensive information management system to support flight data requirements for aircraft operations in the National Airspace System (NAS). This project also involves the development of a comprehensive information system to support the operations of the Air Traffic Control (ATC) system.
- As described previously in this report, this system will enable air traffic controllers to better provide for the separation, control and flight systems to air traffic of all kinds within the airspace controlled by the FAA/ATC.
- When installed, this system will provide, on a supplementary basis, flight information and cartographic data to other information systems within the ATC. In addition, this system will also allow for the maintenance of policies, standards and procedures related to international air traffic.

c. Major milestones

- Project start date: June 1, 1985
- Completion of the technical assessment and options study: September 30, 1986
- Completion of the aeronautical information system: September 30, 1988
- Completion of the source services/data entry phase: September 30, 1990
- Completion of user system interfaces: September 30, 1990
- Overall project completion date: September 30, 1990

d. Total development costs: $300,000.

e. Related development projects.

- 020407 - Obstruction Evaluation and Airport Airspace Analysis (OE/AAA)
- 090410 - Instrument Approach Procedures Automation (IAPA)

2. Obstruction Evaluation in Airport Airspace Analysis (OE/AAA)

a. Project designation: 020407

b. Description

- The purpose of this project is to provide the automated analysis of proposed construction and landing areas that are developed under the Federal Aviation regulations, parts 77, 152, and 157.

- In addition, this system, when installed, will allow for the automated analysis of terminal instrument procedures.
- At the present time, much of this work is done on a manual basis and, as a result, is not done in a standardized or comprehensive manner. The purpose of this system is to standardize these analytical procedures and ensure they are done in a comprehensive and timely manner.
- In addition to the above, one of the primary goals of this system, similar to the goal of the NFDC project, is the provision for increased flight safety due to the better separation, control and flight systems of air traffic.

c. Major milestones

- Project start date: January 1, 1984
- Selection of equipment for interim system field implementation: March 31, 1987
- Conversion of interim software to run in a microcomputer environment: September 30, 1987
- Development of a national plan related to IRMP #407: December 31, 1988

- Project completion date: January 1, 1989

  Note: Interim milestones have been rescheduled from their initial completion date. At this time, the project completion date has not been rescheduled, but logically must extend beyond January 1, 1989.

d. Total development costs: $2,110,000.

e. Related development projects

   - National Flight Data Center (NFDC) Aeronautical Information Management Program (020406)
   - Instrument Approach Procedures Automation (IAPA) (090410)

3. Automated ATC Procedures and Standards Processing

   a. Project designation: 020408

   b. Description

      - This system will enable the automated processing of new and proposed changes to air traffic control procedures and also provide for the automated processing of separation standards.
      - This sytem will enable the dissemination of information concerning changes in the air traffic control procedures and separation stands throughout the ATC system. At the present time, this information is disseminated manually throughout the system and its usage is therefore subject to delay

and misinterpretation. In effect, this system, when installed, would accommodate a database which would be used by all personnel within the ATC.

c. Major milestones

- Project start date: January 1, 1983
- Date input completed and verified: September 30, 1983
- Project completion: scheduled for January 1, 1987 (project not yet completed).

d. Total development costs: $143,500.

e. Related development projects

- Not related to any other development projects. However, this system, when implemented, will be interfaced to a series of other ongoing ATC information systems.

4. Air Traffic Operations and Management System

a. Project designation: 020409

b. Description:

- This project is an ATC-wide information database pertinent to all information related to air traffic management. As stated previously in this report, it is the intention of the ATC to provide all operations personnel with direct computer access through either terminals or microcomputers. Once

this has been accomplished, operations personnel will be able to access, on-line, a series of databases, including the one resulting from the implementation of this system.

- As with most other information systems identified in this report, this system is directly related to the ATC's primary function; that is, the control of aircraft operations throughout the U.S.

c. Major milestones

- Project start date: January 1, 1983
- All interim milestones have been rescheduled due to project delays.
- The published project completion date is still December 31, 1987, although this is no longer valid.

d. Total development costs: $620,000.

e. Related development projects

- Agency Operations System (010506)
- Information Management System (010508)
- Staffing Proportionment Tracking System (010812)
- Air Traffic Administration Management System (ATAMS) (020421)
- NAS Facilities Information System (NFIS) (011012)

5. Air Traffic Resource Management System (ATRMS)

a. Project designation: 020420

b. Description

- While this system is not directly related to ATC operations, it is so intertwined with other operational systems that it has been included in this report.
- The purpose of this system is to provide a comprehensive database, accessible on-line by ATC management personnel. The database is designed to contain that information which is necessary to allow ATC management to schedule resources in accordance with known and predicted future aircraft operational activities.

c. Major milestones

- Project start date: August 1, 1984
- Scheduled project completion date: January 1, 1987. (This project is still under development and requires a rescheduled completion date.)

d. Total development costs: $450,000

e. Related development projects: None.

6. Air Traffic Administrative Management System (ATAMS)

a. Project designation: 020421

b. Description

- This system, in essence, is supplementary to the previously described Air Traffic Resource

Management System. It is an extension of the ATRMS and its purpose is to provide additional support in management scheduling of air traffic controller resources. This system provides more detailed information about the availability of personnel resources and provides the operating levels, as well as the regional ATC offices, with a roll-up capability of this detailed data.

- When installed, the system will provide air traffic controllers with on-line data, enabling them to schedule, by individual, those personnel necessary to meet air traffic control requirements.

c. Major milestones

- Project start date: January 1, 1983
- No interim milestones have been scheduled.
- The project completion date was initially scheduled for March 31, 1987. This date requires rescheduling.

d. Total development costs: $4,073,600.

e. Related projects

- Air Traffic Operations and Management Information System (020409)

7. Air Traffic Operational Planning and Requirements Analysis System (OPRAS)

a. Project designation: 020422

b. Description

- The purpose of this system is to act as an overall ATC-related umbrella system, tying together all the various other ATC operations information systems. In other words, its purpose is to provide a vehicle to integrate the myriad air traffic data and information systems into a common framework and to provide for the delivery of operational data to all the various elements of the ATC, and to related agencies.
- The system is being designed to interface with various office automation systems, primarily through the use of microcomputers, and to the various databases related to the operational systems. In effect, the system enables the total automation of the Air Traffic Control function.
- This project is as much related to the integration of other systems as it is a discrete system in its own right. That is, budgeted expenditures for this system will allow for software development for a variety of purposes in the automation of various air traffic control procedures throughout the entire ATC organization.

c. Major milestones

- Project start date: June 30, 1987
- Project completion date: September 30, 1992

d. Total development costs: $12,816,000.

e. Related projects

- National Flight Data Center (NFDC) Aeronautical Information Management Program (020406)
- Obstruction Evaluation and Airport Airspace Analyses (OE/AAA) (020407)
- Automated ATC Procedures and Standards Processing System (020408)
- Air Traffic Operations and Management Information System (020409)
- Air Traffic Resource Management System (020420)
- Air Traffic Administration Management System (ATAMS) (020421)

8. Instrument Approach Procedures Automation (IAPA)

a. Project designation: 090410.

b. Description:

- This project provides for the automation of the creation, filing, storage and transmittal of all information pertaining to flight plans developed under Instrument Flight Rules (IFR). As was stated previously, IFR flight plans are now developed

manually, transmitted electronically, and manually stored in the various ATC centers. Such a system is rife with the potential for error and subsequent serious safety hazards. The purpose of this system is to overcome the current shortfalls.

- In addition, this system will facilitate the flight inspection of air navigation facilities and the logistics flight program. The system will enable the input of various types of data, and its on-line storage and use, within the context of developing IFR flight plans.

c. Major milestones

- Project start date: January 1, 1984
- Major system enhancements: December 31, 1990
- Project completion: January 31, 1989

d. Total development cost: $6,117,100.

e. Related projects

- National Flight Data Center (NFDC) Aeronautical Information Management Program (020406)
- Obstruction Evaluation and Airport Airspace Analyses System (OE/AAA) (020407)

B. Existing Projects - Budgeted For Enhancements

1. Aeronautical Information System

a. Project designation: 020411

b. Description

- This is an information storage and retrieval system, specifically designed for the storage, retrieval and updating of flight oriented information.
- The system can be looked upon as a database containing individual and summary information pertaining to all past, current, and future filings, of aircraft flight plans. The system can be used for operational purposes as well as management and administrative purposes, all related to aeronautical information. The database will also contain information pertaining to airspace, navigation and communication systems, all related to the national airspace systems.

c. System hardware

- IBM 3081
- Harris terminals, controllers and display stations.
- Hazeltine 2000

d. Annual operating costs: $1,590,000.

2. Air Traffic Operations Service Publications System

a. Project designation: 020412.

b. Description

- This is an on-line database system, enabling the storage, retrieval and updating of data pertaining

to all publications related to the ATC. One of the primary purposes of the system is to eliminate the previous problems resulting from different individuals within the ATC using different versions of ATC publications. This type of situation can easily result in different individuals using conflicting data during the same period of time.

c. Hardware

- PDP 11-70
- IBM PC

d. Annual operating costs: $415,000.

3. Airspace Rules Processing and Reporting System (ARPRS)

a. Project designation: 020413

b. Description

- ARPRS is a database system that contains airspace descriptions, history and related data pertaining to airspace within the U.S. This system is maintained in accordance with the Code of Federal Regulations, parts 71, 73 and 75.
- As was the case with the previously described system, this is an on-line database system; it enables ATC operations and administrative personnel to retrieve data pertaining to the U.S. airspace.

c. Hardware

- Wang VS-100-a

d. Annual operating costs: $132,000.

4. Air Traffic Rules Information Processing System (AIRTRIPS)

a. Project designation: 020414

b. Description

- Similar to #3, above, this is an on-line database system with storage and retrieval capabilities. It's purpose is to store all data related to the statute descriptions, and historical data pertaining to petitions, exemptions and rule-making actions associated with certain portions of the Federal Aviation regulations.

- Various organizations, both private and public, petition the FAA for exceptions, exemptions and changes to the Federal Aviations regulations. In certain cases, when these changes are granted, they are permanent in nature; in other cases they are temporary. This database enables anyone with the right to know, to extract and review all data pertinent to a given Federal Aviation regulation.

c. Hardware

- Wang VS-100-E

d. Annual operating costs: $150,000

5. Aircraft Management Information System (AMIS)

a. Project designation: 090485

b. Description

- This is another ATC database system. It provides for the storage, retrieval and updating of records pertaining to the FAA aircraft test fleet. The FAA maintains a series of test aircraft so that the FAA can determine the various characteristics of commercial and general aircraft.
- Operational data pertaining to these aircraft are maintained in a database and are used for a great variety of ATC and FAA purposes.
- The purpose of this system is to control, coordinate and allocate the FAA aircraft fleet. It is also used to develop statistics stemming from the use of this aircraft fleet to determine the results of flight inspections of various air navigation facilities throughout the U.S. An ancillary purpose of this system is to determine, store and retrieve aircraft flight safety data.

c. Hardware

- IBM 3081
- IBM System 36
- Telex terminals
- Telex printers
- IBM PC's

d. Annual operating costs: $1,940,600.

6. Obstruction Evaluation, and Airport Airspace Analysis (OE/AAA)

a. Project designation: 190407

b. Description

- This system, another database oriented system, enables the storage, retrieval and updating of the myriad amounts of data pertaining to airports and airspace facilities throughout the United States. The system is capable of storing data used by the four divisions of the ATC:
  - Air Traffic
  - Airway Facilities
  - Flight Standards
  - Airports
- The system has formed a cornerstone in the overall complex of ATC information systems. It will be linked into many of those additional ATC systems which are under development. The system will be used for flight standards inspections, certification and surveillance services, as well as airport development and certification activities.

c. Hardware

- Data General MV/8000
- Data General DT mod 30

d. Annual operating costs: $506,500

7. Management Information

a. Project Designation: 090413

b. Description

- This is a classical management information system, containing detailed and summary information, pertaining to specific aspects of the ATC function.
- The system is primarily oriented toward providing improved summaries of aircraft program costs and accomplishments.

c. Hardware

- IBM 3081
- IBM System 36
- Telex Terminals [42]
- IBM PC's [35(+)]
- Telex Printers [40]

d. Annual Operating Costs: $116,700

8. Air Traffic Count System

a. Project designation: 120409

b. Description

- This system is, in effect, a database centered, management information system.
- The system is designed to provide statistical information for air traffic management.

c. Hardware

- Data General MR/8000

d. Annual operating costs: $23,500

## IV. Market Forecast for ATC and Airspace Information Resource Expenditures

### A. Introduction

- It must be noted that the ATC and Airspace Segment of the total FAA Information Resources Management (IRM) Plan is but one of thirteen segments comprising the overall plan. By limiting its interest to this segment only, DEC is, in the context of funded development projects, limiting itself to a relatively and absolutely, small market segment.
- As stated previously, Chapter V addresses the much larger potential market circumscribed by funding from the Airport and Airway Development Act. However, this chapter deals solely with funded and budgeted ATC and Airspace system expenditures.

### B. ATC and Airspace As Part of the Overall IRM Plan

- Exhibit IV-1 contains summary figures for IRM expenditures, by FAA information area.

Exhibit IV-1

IRM Development Costs - By Information Area

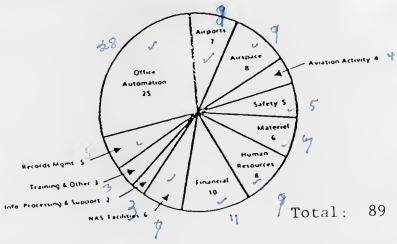
| | INFORMATION AREA | DEVELOPMENT COSTS ($MILLIONS) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | PAST TOTALS | FY87 | FY88 | FY89 | FY90 | FY91 | FY87-FY91 |
| 1. | Airports | 4.2 | 0.8 | 1.6 | 0.8 | 0.0 | 0.0 | 3.2 |
| 2. | Air Traffic Control (ATC) and Airspace | 26.6 | 4.2 | 8.0 | 2.6 | 1.8 | 1.2 | 17.7 |
| 3. | Aviation Activity | 6.9 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 1.1 |
| 4. | Aviation Safety Analysis System | 55.7 | 10.9 | 6.0 | 3.0 | 0.0 | 0.0 | 19.9 |
| 5. | Financial Resources | 15.0 | 0.4 | 4.4 | 4.5 | 2.6 | 0.1 | 11.9 |
| 6. | Human Resources | 2.8 | 0.6 | 1.1 | 0.5 | 0.0 | 0.0 | 2.1 |
| 7. | Materiel Resources | 25.4 | 2.6 | 6.8 | 1.4 | 1.4 | 1.8 | 14.1 |
| 8. | National Airspace System (NAS) Facilities | 12.8 | 1.9 | 1.0 | 0.7 | 0.4 | 0.0 | 4.1 |
| 9. | Office Automation and Management Support | 104.4 | 17.8 | 22.3 | 21.0 | 10.1 | 5.0 | 76.3 |
| 10. | Information Processing and Support | 13.6 | 3.7 | 3.5 | 3.0 | 0.0 | 0.0 | 10.1 |
| 11. | Human Interface and Training | 8.5 | 0.0 | 8.5 | 0.0 | 0.0 | 0.0 | 8.5 |
| 12. | Other | 0.5 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| 13. | Records Management | 0.6 | 0.5 | 0.1 | 0.0 | 0.0 | 0.0 | 0.5 |
| | TOTAL | 277.0 | 44.7 | 63.2 | 37.5 | 16.3 | 8.1 | 169.7 |

- The "Past Totals" column indicates funds already expended, prior to F.Y. 1987. The other columns show information system expenditures, by fiscal year, by information area.

- Exhibit IV-2 illustrates the number of IRM development projects, by information area. That is, Exhibit IV-2 gives the number of projects that are funded at the dollar levels shown in Exhibit IV-1.

Exhibit IV-2

Number of IRM Development Projects - By Information Area




o Exhibits IV-3 and IV-4 show the proportional amount of IRM expenditures, by information area, for F.Y. 1987 (Exhibit IV-3) and, in summary form, for F.Y. 1987 - F.Y. 1991, inclusive. It can be seen, by examining these exhibits, that office automation projects comprise, by far, the largest single information area.

Exhibit IV-3

IRM Development Costs - By Information Area, F.Y. 1987

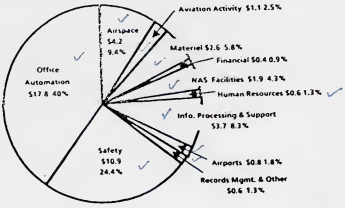
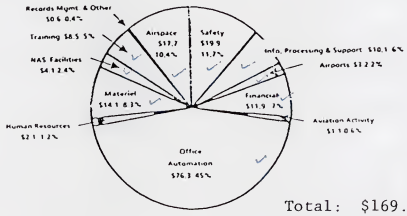


Exhibit IV-4

IRM Development Costs - By Information Area

F.Y. 1987 - F.Y. 1991, Inclusive




Total: $169.7M

45
11.7
10.4
8.3
7
6
5
2.4
2.0
1.2
.6

- Exhibit IV-5 lists the number of existing information systems, by information area. Category 2, ATC and Airspace includes those systems listed in Chapter III-B of this report.

Exhibit IV-5

Existing FAA Systems By Information Area

| | INFORMATION AREA | NUMBER OF ONGOING SYSTEMS |
|---|---|---|
| 1. | Airports | 15 |
| 2. | Air Traffic Control (ATC) and Airspace | 16 |
| 3. | Aviation Activity | 7 |
| 4. | Aviation Safety Analysis System | 23 |
| 5. | Financial Resources | 40 |
| 6. | Human Resources | 24 |
| 7. | Materiel Resources | 32 |
| 8. | National Airspace System (NAS) Facilities | 40 |
| 9. | Office Automation and Management Support | 27 |
| 10. | Information Processing and Support | 11 |
| 11. | Human Interface and Training | 8 |
| 12. | Other | 37 |
| 13. | Records Management | 3 |
| | TOTAL | 283 |

- It was the original intent of INPUT to elaborate on the summary data contained in Exhibits IV-1 through IV-5, and on the detailed data contained in Chapter III. However, it became apparent that there was a wide divergence between the data contained in the applicable FAA documentation and the information that INPUT received during the interviews with key FAA/ATC personnel.

- Rather than continue within the original scope of the project, it was considered more meaningful to expend additional effort on defining a broad understanding of the FAA/ATC systems environment, as opposed to analyzing in

detail a series of published documents that are formally correct but, in actuality, are no longer meaningful.

- The information contained in the previous chapters of this report is, to the best of INPUT's knowledge, basically correct and pertinent to DEC's interest. The only known exception to this is that the budget figures and project milestone dates for the specific information projects are no longer valid.

- Please refer to Chapter V, Conclusions and Recommendations, for INPUT's suggestions relative to DEC's strategy in regard to the FAA/ATC.

## V. CONCLUSIONS AND RECOMMENDATIONS

### A. Introduction

- This chapter contains those conclusions that INPUT has derived from its research, together with INPUT's recommendations to Digital Equipment Corporation. As stated previously, the project took on a new dimension when it was determined that the detailed FAA systems descriptions, as published by the U.S. Department of Transportation, had been obsoleted by various recent events.
- INPUT changed the project's direction, and instead of pursuing additional detailed data concerning FAA/ATC system projects, the project's efforts were redirected to confirming our understanding of the reasons for the various budgetary discrepancies and, based on this knowledge, putting forth a set of recommendations for DEC; recommendations that are valid in the context of the current FAA systems development environment.

### B. Conclusions

1. The most recent system documents published by the FAA are not representative of the present and future scope of system activities within the FAA/ATC. The three primary documents that are referred to, are:

   a. National Airspace Systems Plan - April, 1987

b. Information Resources Management Plan, Vol. I - Strategic Overview

c. Information Resources Management Plan, Vol. II - Systems Plan.

Telephone interviews with FAA personnel indicate that these documents are being superceded by new documentation, scheduled for release in February, 1988. This has been confirmed by knowledgeable INPUT staff members at INPUT's Washington, DC, office, who are closely associated with the FAA's budgeting process.

2. There are a number of reasons for the FAA information systems budgetary hiatus. A summary of the situation appears below:

a. Legislation enabling the creation of a national trust fund was passed by Congress in 1980. The essence of the legislation was to create a "use" tax (8% tax on all commercial airline tickets) that would be deposited in an off-budget fund. The monies in this fund would be used for various projects related to flight safety. It is not necessary to describe all aspects of the trust fund; however, the following points are pertinent:

- While there are a number of sources of monies for the trust fund, the majority comes from the 8% airline ticket tax.
- The legislation has to be periodically re-enabled by Congress.

- The fund grows at a rate of approximately $4.0 billion per year; $3.0 billion from the inflow of new funds and $1.0 billion from interest earned on the principal.
- The trust fund currently contains about $9.0 billion, all dedicated, by law, to furthering aviation safety.
- Approximately $2.7 billion per year have been drawn down from the trust fund (in the last several years). Much of this money is for "bricks and mortar." However, about $1.4 billion (of the $2.7 billion) is expended on "Facilities and Engineering" (F&E) projects. It is from these F&E funds that FAA information systems projects are funded.
- The FAA's NAS plan (previously described) is budgeted at over $720 million for 1988. Almost all of this amount is from the F&E portion of the trust fund.

3. The published FAA information systems planning documents do not reflect any trust fund monies; thus the vast discrepancy between the budget figures in these documents and the commonly accepted expenditure figures that include trust fund monies.

4. In December, 1987, Congress authorized the expenditure of an additional $5.6 billion from the trust fund. It is

expected that the FAA budgetary documents scheduled for release in February, 1988, will reflect the planned expenditure of at least a portion of the $5.6 billion. It is reasonable to assume that the FAA/ATC had anticipated the release of these funds, and thus, that the appropriate documentation could be released within a short time of the enactment of the enabling legislation (i.e., February, 1988).

5. Trust fund monies aside, it is important for DEC personnel to understand the nature of certain major FAA/ATC information systems projects that are not described in the FAA documentation:

- Re-Hosting. IBM and CSC have been awarded a contract from the FAA to replace the host systems in the 26 air traffic centers. This contract was awarded after competitive bidding between IBM and Sperry (Unisys). This project is described in the FAA's NAS plan, although the plan does not define the competitive bidding process, nor does it describe the present state of the project. Based on the knowledge that we gained from a variety of sources, this project will be completed within the next 12-18 months.
- Sector Suites. The NAS plan also refers to an updating of the ATC's sector suites. This project has as its goal, the complete replacement of all the air traffic system components in each air traffic sector.

This project is currently in a "shoot-out" stage, with IBM and Hughes the two remaining prime contract contenders. The price tag for the upgrading of the sector suites has been placed within a range of $13-25 billion, expended over 10-12 years. We have also learned that each of these two contenders are probably expending significant amounts of their own funds (in addition to FAA funding) to demonstrate their systems' capabilities.

- OATS/CORN. These are two office automation systems that will be installed in the FAA.

  OATS (Office Automation Technology System) is primarily a project that will enable the upgrading of the FAA's office automation system, as well as allow office automation equipment purchases in other areas of the DOT. The overall expenditures are estimated to be $500-$800 million.

  CORN (Computer Resources Nucleus) is intended to provide funds for a variety of FAA information systems resources over a five year period. These resources will include software, training, technical support, hardware, etc. Expenditures are estimated to be at least $100 million, through FY 1992.

These projects are outside the original scope of the assignment, but we mention them as they are still subject to bidding and may deserve further investigation by DEC.

- Program Management. Martin-Marietta currently holds the program management contract for the NAS plan. In effect, Martin-Marietta has contracted with the FAA to act as the program manager for all systems development activities, as described in the NAS. This is a multi-year plan that will probably result in fees of approximately $1.0 billion for Martin Marietta. It is our understanding that this project is funded through the trust fund.

6. Liability Insurance. At the current time, the Federal government has adopted the attitude that, whenever a vendor supplies a system involved in public safety, the vendor (not the government) assumes all liability for system failure. Thus, a hardware vendor could be liable for compensation for any deaths or injuries sustained due to an aircraft accident while the aircraft was under the control of an information system supported by the vendor's hardware.

We have been informed that the premium for insurance against this risk is $300,000 per $1.0 million in coverage. We point this out simply to remind DEC that they must investigate this factor before becoming committed to the FAA information systems market.

C. Recommendations

1. We strongly suggest that DEC suspend its efforts in investigating the FAA/ATC market until the systems documentation, scheduled for release in February, 1988, can be received and analyzed. We believe that this documentation will present a much more complete and accurate description of the potential market.

2. As a function of 1., above, we also suggest that INPUT's activities in this regard be suspended at this point. We further suggest that the unexpended project money be expended in examining the new documentation, when made available by the FAA.

3. We further recommend that DEC assign one, or more, of its Washington, DC, office staff, to become familiar with the FAA/ATC. Since it is improbable that the trust fund will become a semi-permanent part of the FAA budgeting process, we suggest that DEC regularly examine the trust fund allocation to FAA for expenditures. These trust fund dollar amounts are significant, and the use of funds by DEC in tracking these expenditures would appear to be well worth while. The INPUT Washington office would be pleased to assist in getting this effort started.

4. We also recommend that, if DEC believes it has the ability to successfully compete in the FAA systems market, it

broaden its scope beyond the FAA's air traffic control systems. We make this recommendation for two reasons:

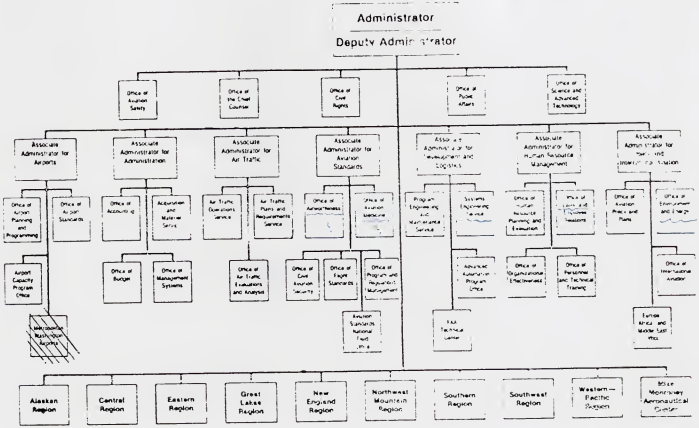
- The re-hosting project and the sector suite project are heavily dominated by IBM. We question if it would be realistic for DEC to assume a significant degree of success in these areas at this time.
- Significant amounts of funds are being spent by the FAA in other areas. Specifically, we suggest immediate investigation of the OATS and CORN projects. These may still be open for vendor proposals and are each signficant in dollar magnitude.

5. Within the context of the DOT/FAA, we further recommend the following actions:

- Investigate the possibility for hardware upgrades at the Transportation Systems Center in Cambridge, MA. This is a DOT research center, equipped with DEC VAX's. We have learned that this center may be converted into a quasi-public agency and thus, there may be some changes in mission.
- Review the current GSA computer equipment inventory database, available on tape. This database will give the geographic locations of all FAA computer hardware. Other, non-government reports, can help identify installation dates and thus help project replacement, or upgrade dates. This might give DEC a "foot-in-the-door" at the FAA.

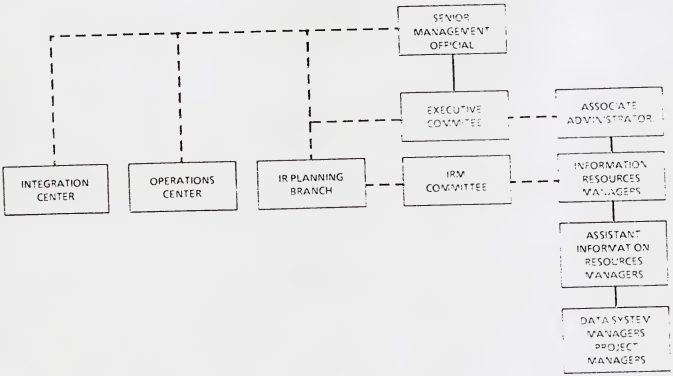
6. Regardless of any other activity, we strongly recommend that DEC undertake a strenuous legal review of its liability exposure in the air traffic systems marketplace. If the potential financial exposure is as great as we have been led to believe, then this subject deserves the attention of management as part of its exploration of the FAA market.

ATTACHMENT 1
FEDERAL AVIATION ADMINISTRATION ORGANIZATION CHART



ATTACHMENT 2
FEDERAL AVIATION ADMINISTRATION INFORMATION SYSTEMS STRUCTURE

The information flow and reporting responsibilities for IRM activities are shown in the diagram.



## ATTACHMENT 3
## TOTAL NATIONAL AIRSPACE SYSTEM ACTIVITY

| | 1982 | 1985 | 1990 | 2000 | Percent Growth 1982-2000 |
|---|---|---|---|---|---|
| NPIAS Airports (Existing)* | 3195 | 3219 | 3472 | 3699 | 15.8 |
| Airport Operations (millions) | | | | | |
| Aircraft Operations | 127.6 | 143.0 | 139.5 | 181.3 | 42.1 |
| Itinerant Operations | 68.0 | 78.8 | 84.7 | 113.0 | 66.2 |
| Instrument Operations | 31.7 | 38.7 | 45.4 | 55.8 | 76.0 |
| Towered Airport Operations | 50.6 | 57.9 | 65.7 | 82.2 | 62.5 |
| ARTCC Operations (millions) | | | | | |
| IFR Aircraft Handled | 27.9 | 32.7 | 38.7 | 47.2 | 69.2 |
| ACF Approach Control Operations** | ---- | ---- | ---- | 55.4 | ---- |
| FSS Service (millions) | 62.4 | 52.9 | 49.3 | 56.3 | (9.8) |
| Hours Flown (millions) | | | | | |
| Air Carrier | 6.1 | 7.4 | 10.1 | 12.8 | 109.8 |
| General Aviation | 37.8 | 36.6 | 34.0 | 37.1 | (1.9) |
| Military | 6.2 | 5.9 | 6.4 | 7.1 | 14.5 |
| Domestic Enplanements (Revenue Passenger) (millions) | | | | | |
| Air Carrier | 272.8 | 348.4 | 468.5 | 707.2 | 159.2 |
| Commuter | 17.8 | 24.2 | 34.6 | 63.1 | 254.5 |
| Aircraft Fleet (thousands) | | | | | |
| Air Carrier | 2.5 | 2.9 | 3.6 | 4.3 | 72.0 |
| Commuter*** | 1.4 | 1.5 | 1.7 | 2.2 | 57.1 |
| Total General Aviation | 213.3 | 220.9 | 208.7 | 222.0 | 4.1 |
| Civil Helicopter*** | 7.0 | 7.1 | 7.0 | 9.0 | 28.5 |
| Total Military | 21.7 | 19.9 | 21.2 | 22.2 | 2.3 |
| Military Helicopter*** | 9.7 | 7.3 | 8.9 | 9.3 | (4.1) |
| Pilots (thousands) | | | | | |
| Instrument Rated | 252.5 | 256.6 | 264.7 | 277.0 | 9.7 |
| Total Pilots | 764.2 | 722.4 | 697.4 | 731.6 | (4.3) |

* Aircraft operations forecasts are based on the existing airports included in the National Plan of Integrated Airport Systems (NPIAS).

** Approach control operations conducted for area control facilities equal the number of instrument operations conducted by towers.

*** Civil Helicopter and Commuter Fleets are included in the Total General Aviation Fleet. Military Helicopter Fleet is included in Total Military Fleet.